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ABSTRACT

A study evaluated the labor market outcomes of individuals with various types of postsecondary educational experiences. In particular, it examined differences among three groups: students who pursued technical education programs; those who pursued academic programs; and those individuals who did not pursue any type of postsecondary education. The study used empirical evidence from the National Longitudinal Survey of High School Students in 1972 concerning the relationship between economic outcomes and grades earned and the degree to which the labor market rewarded credentials. Wages and earning models yielded different structural parameter estimates when based on the three different populations. The differences were most dramatic for high school background effects and for postsecondary characteristics. The empirical results from the technique used to correct for self-selection suggested that individuals' choices among the three postsecondary tracks were not the result of absolute advantage. (Contains 16 references.) (YLB)

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Postsecondary Education as Triage

Returns to Academic and Technical Programs

Kevin Hollenbeck

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Postsecondary Education as Triage:

Returns to Academic and Technical Programs

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April 1992

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Abstract

This paper examines the labor market outcomes of individuals with various types of postsecondary educational experiences. In particular, it examines differences between students who have pursued technical education programs from those who have pursued academic programs and from those individuals who have not pursued any type of postsecondary education. Empirical evidence is presented concerning the relationship between economic outcomes and grades earned and the degree to which the labor market rewards credentials. Wage and earnings models yield different structural parameter estimates when based on the three different populations. The differences are most dramatic for high school background effects and for postsecondary characteristics. The empirical results from the technique used to correct for self-selection suggest that individuals' choices into the three postsecondary tracks are not the result of absolute advantage.

POSTSECONDARY EDUCATION AS TRIAGE:

RETURNS TO ACADEMIC AND TECHNICAL PROGRAMS

Human capital theory suggests that individuals decide to pursue postsecondary education based on a comparison of expected benefits in the form of enhanced lifetime earnings (and perhaps nonpecuniary benefits that accrue to the individual) to investment costs that include direct costs and foregone earnings. Wage and earnings advantages to education beyond high school are well-known and have been estimated in many studies.[1] However, most of these studies assume implicitly that years of education beyond grade 12 are homogeneous with respect to their productivity-enhancing features. But, of course, postsecondary education qualities vary widely. Institutional characteristics differ. Curricula differ. The motivational factors of and efforts put forth by students differ, for example.

The purpose of this paper is to examine the labor market outcomes of individuals with various types of postsecondary educational experiences. In particular, it examines differences between students who have pursued technical education programs from those who have pursued academic programs and from those individuals who have not pursued any type of postsecondary education. In the course of this examination, the paper will present evidence concerning the relationship between economic outcomes and grades earned and the degree to which the labor market rewards credentials.

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[1]McMahon (1991) and Murphy and Welch (1989) are two recent studies. Leslie and Brinkman (1988) present a meta-analysis of several dozen other studies.

Background

In 1991, about 2.5 million individuals graduated from public or private high schools in the U.S.[2] In 1988, about 400,000 individuals received their GED (General Educational Development) certificates. As many as three-quarters of these high school graduates and GED earners will pursue some form of postsecondary education.[3] Unlike most of elementary and secondary schooling, postsecondary education is not compulsory. So individuals must make their own educational choices. These choices include specific institution, program/ major, intensity of attendance (part-time or full-time, for example), and effort to put forth.

Many observers suggest that the U.S. higher education system is difficult to traverse because of its decentralized and duplicative nature. For example, several institutions in an area will offer the exact same program or will offer programs with similar names, but quite different content. This paper takes a broader focus and suggests that the system is reasonably rational. Figure 1 abstracts from the details of the system and presents it as a process of triage. Individuals completing their secondary schooling careers select (or are selected) to pursue formal vocational education at the postsecondary level (referred to here as postsecondary technical education), to pursue an academic program with the intent of

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[2]U.S. Department of Education (1991), table 95.

[3]Cameron and Heckman (1991) analyze outcomes for GED earners and find that they are not equivalent to high school graduates in terms of labor market outcomes, but are more similar to high school dropouts. Their bleak prognoses for GED earners are tempered only slightly by the finding that some individuals acquired the GED as an entry requirement to pursue postsecondary schooling, and these individuals received returns from that level of schooling.

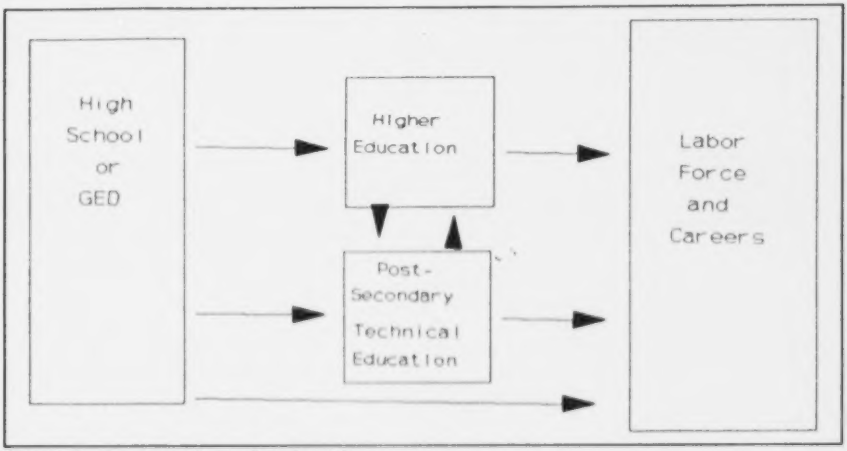

Figure 1. Postsecondary education triage.

completing a baccalaureate degree (referred to here as higher education), or to discontinue their formal education. A strength of the system is that it is reasonably open; individuals may flow into and between either of the postsecondary options fairly easily.[4]

The two key questions facing the postsecondary educational policymakers concerning the system are its equity of access and accountability. These questions fit well the triage analogy. The advantage of triage is its allocative efficiency. Resources are utilized on a priority basis similar to moving along a marginal benefit schedule. If the triage process fails and decisions about placement in the queue are made on the basis of factors other than medical need, for example on factors such as rank, ethnicity, or ability to pay, then the

[4]In fact, many individuals who initially choose a postsecondary track do not complete their programs (see Tinto, 1987). These individuals may be thought of as exercising the choice of entering the "no postsecondary schooling" track.

system's allocative efficiency is compromised. So the performance of the system depends on equal access. Similarly, the goals of postsecondary education will be compromised if the selection process is based on race, sex, income, or some other characteristic not related to educational choice.

The accountability issue relates to overall system efficiency. Overall performance of any system—medical or educational triage—can be measured by comparing outcomes to inputs. Optimization requires minimizing costs to achieve the same outcomes, or maximizing outcomes given the same level of inputs. Postsecondary education must be held accountable for achieving its educational and economic objectives in an efficient manner.

Data

The data used in this study come from the National Longitudinal Survey of Students in 1972 (NLSS72). A representative sample of 22,652 individuals in their senior year of high school were surveyed in Spring 1972, and follow-up surveys were conducted in 1973, 1974, 1976, 1979, and 1986.[5] Postsecondary transcripts were obtained for approximately 90 percent of the sample who reported attending some sort of postsecondary education program. The empirical work in this paper uses only those observations for which individuals responded to the survey in the base year plus all five follow-up surveys (n = 8,992). Observations with valid data for each wave, but for whom the transcript data were missing were not excluded from the sample, however.

[5]The sample size for the 1986 wave was cut approximately in half. See Tourangeau and others (1987).

Table 1 describes the personal background, high school experiences, and geographic location of the sample, by whether the individuals attended higher education, postsecondary technical education, or no postsecondary institution. For individuals who chose both postsecondary technical education and higher education, the categorization in the table represents their final status.[6] The averages shown in table 1 are derived from data collected in the base year of the survey, so these are characteristics relevant to the individuals' subsequent postsecondary decisionmaking.

The three populations differ from each other in most dimensions, but particularly apparent are the differences in parental education, SES (a composite indicator of socioeconomic status that includes parental education), ability, high school characteristics, and residence in an urban area. The differences in average ability between the nonattenders and the higher education sample is larger than a standard deviation and the difference in mean(self-reported) high school grades is approximately one standard deviation.

Table 2 shows differences in various postsecondary attributes between the individuals who pursued postsecondary technical education and those who pursued higher education. Not surprisingly, the latter averaged more months of attendance and higher average grades. The degree or certificate completion rate is about 70 percent for individuals who pursued postsecondary technical education and about 80 percent for higher education. All together, about 45 percent of the individuals who pursued postsecondary education obtained a

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[6]It is well-known that many individuals pursue a one- or two-year technical education degree at a vocational/technical institution or community college and then transfer to a four-year institution to work on a bachelor's degree. Less well-known are "reverse transfers;" individuals who receive a bachelor's degree, find it difficult to pursue a career, and transfer back into a one- or two-year vocational program.

Table 1

Mean Personal Background and High School Characteristics, by Postsecondary Outcome[a]

Characteristic	No Postsecondary Attendance	Postsecondary Technical Education	Higher Education	Total[f]
Personal Background				
Female	.576	.562	.509	.536
Minority	.175	.196	.137	.162
Handicapped	.068	.051	.039	.047
Siblings	2.331	2.104	2.068	2.126
Mother's Ed[b]	1.682	2.088	2.465	2.208
Father's Ed[b]	1.684	2.169	2.716	2.365
SES[c]	-.412	-.093	.255	.030
Ability[d]	8.348	10.508	13.731	11.800
Age (April '72)	17.606	17.475	17.369	17.446
High School Characteristics				
Academic/College-prep curriculum	.109	.335	.675	.472
General curriculum	.446	.354	.238	.310
Vocational curriculum	.446	.310	.086	.218
Grades[e]	6.190	7.307	8.954	7.968
Geographic Location				
Northeast	.228	.190	.238	.221
North Central	.306	.317	.276	.293
South	.330	.302	.312	.312
West	.136	.191	.175	.173
Urban	.182	.266	.356	.298

Notes:[a] Sample sizes differ for each characteristic because of item nonresponse. For the "No Postsecondary Attendance" column, sample sizes range from 1349 for high school grades to 1414 for several characteristics. For "Postsecondary Technical Education," sample sizes range from 2110 for ability to 2226 for several characteristics. For "Higher Education," sample sizes range from 4602 for ability to 4804 for several characteristics. For the "Total" column, sample sizes range from 8595 for high school grades to 8992 for several characteristics.

Notes: (continued)

[a] Individuals who pursued both postsecondary technical education and higher education are categorized by their final status.
[b] Categorical variable ranging from 1=LT HIGH SCHOOL to 5=MA,PHD.
[c] Socioeconomic status composite indicator variable comprised of family income, parental education, parental occupation, and educational belongings in the home (books, newspapers, etc.).
[d] Composite test score ranging from 0 to 25.
[e] 14 point scale: 14=A+; 12=A-; ... 3=D-; 2=F; 1=LT F. Imputation algorithm designed and performed by U.S. Department of Education.
[f] Includes approximately 500 observations who reported some postsecondary attendance, but for whom final postsecondary outcome could not be determined.

Table 2

Mean Postsecondary Educational Experience Characteristics, by Postsecondary Outcome

Characteristic	Postsecondary Technical Education	Higher Education	Total with some Postsecondary Attendance
Months attended	21.32	51.13	39.08
Attended a community or junior college	.418	.423	.411
Postsecondary grades (self-report)*	5.245	5.335	5.307
Postsecondary grades (transcript)	2.570	2.794	2.739
Earned a credential	.693	.787	.725
Vocational degree or certificate	.637	.354	.433
Bachelor's degree	.129	.661	.459
Both Voc. cert. and bachelor's	.073	.228	.167
Percent vocational credits	29.1	7.5	12.7
Reported having had both an academic and vocational major	.323	.230	.241

Notes: Sample sizes differ for each characteristic because of item nonresponse. For the "Postsecondary Technical Education" column, sample sizes range from 886 for transcript-reported grades to 2226 for several characteristics. For the "Higher Education" column, sample sizes range from 3458 for transcript-reported grades to 4804 for several characteristics. For "Total with some Postsecondary Attendance," sample sizes range from 4470 for transcript-reported grades to 7563 for several characteristics.

* 7-point scale: 7=mostly A's (4.0); 7=half A's and B's (3.5); 6=mostly B's (3.0); ... 1=mostly D's or below (1.0).

bachelor's degree; about two-thirds of those in the higher education track and one-eighth of those in the postsecondary technical education track. Interestingly, about 40 percent of both groups attended a community or junior college (does not include vocational/technical institutes).

How did the educational choices of these individuals affect labor market outcomes? Table 3 presents the economic outcomes that were achieved by these students. The table also presents information concerning the individuals' latest family status (in 1986). Average tenure and total work experience (since high school graduation) are similar for all individuals; although the statistically significant lower average tenure for individuals in the higher education track may imply higher rates of job mobility. Much higher percentages of individuals with some postsecondary education reported receiving formal on-the-job training than their nonattendee counterparts. For example, over half of the individuals in the higher education track received formal on-the-job training (ojt), whereas only about one-third in the nonattendee track received such training. Postsecondary technical education attendees had a 16 percent hourly wage advantage over nonattendees and a 21 percent annual earnings advantage. Higher education attendees, in turn, had a 22 percent wage advantage and a 32 percent annual earnings advantage over individuals who pursued postsecondary technical education.

Model and Empirical Results

Because the composition of the three tracks of individuals differs, it is necessary to perform multivariate analyses to disentangle the payoffs to various types of postsecondary programs. Assuming that postsecondary choices are unfettered, economic theory suggests

Table 3

Mean Labor Market-Related and Current Family Characteristics, by Postsecondary Outcome

Characteristic	No Postsecondary Attendance	Postsecondary Technical Education	Higher Education	Total
Labor Market-Related				
Tenure (months)[a]	55.63	49.05	46.32	48.66
Total work experience (months)[b]	112.64	116.45	114.02	114.35
Received formal OJT	.332	.472	.539	.485
Hourly wage (Spring '86)[a]	8.54	9.92	12.09	10.87
1985 Annual earnings[b]	13,420.69	16,198.21	21,344.74	18,462.87
Currently employed	.78	.80	.84	.82
Current Family Characteristics				
Ever married	.852	.807	.758	.788
Any kids	.833	.734	.588	.674
# of children[c]	1.794	1.508	1.104	1.344

Notes: Sample sizes differ for each characteristic because of item nonresponse. For the "No Postsecondary Attendance" column, sample sizes range from 1067 for hourly wage to 1414 for total work experience. For the "Postsecondary Technical Education" column, sample sizes range from 1850 for hourly wage to 2226 for total work experience. For "Higher Education," sample sizes range from 4166 for hourly wage to 4804 for total work experience. For the "Total" column, sample sizes range from 7498 for hourly wage to 8992 for total work experience.

[a] Mean is conditional on nonzero values.
[b] Mean includes zero values.
[c] Variable is set to 0 if the respondent reported no children at all and is truncated at 5 for 5 or more children.

that individuals will choose to maximize the returns on their educational investments. It is not unreasonable to assume that information concerning the costs of these choices is generally available. However, the (expected) payoffs from various choices bear considerably more uncertainty. It is these payoffs, or returns, that we examine here.

The starting point for the empirical work in this paper is a human capital model (based on Mincer 1974) in which individuals maximize their lifetime earnings. The model yields the following ex post payoff function[7], expressed in empirical terms:

$$(1) \qquad \ln w_{it} = \beta X_{it} + \gamma P_i + \epsilon_{it}$$

where $\ln w_{it}$ is annual earnings of individual i in year t; X_{it} is a vector of personal and educational background characteristics of individual i; P_i is a vector of postsecondary educational experiences of individual i; and ϵ_{it} is an individual-specific error term. Included in X are personal characteristics such as sex, race/ethnicity, socioeconomic status of family, and a measure of ability[8]; secondary school characteristics; and work experience characteristics such as tenure on current job, experience, and job training. The Mincer model suggests that years of education beyond grade 12 defines P; however, this paper decomposes the effects of P by examining postsecondary educational characteristics such as academic or vocational program, type of institution, credential earned, and grades earned. The paper also

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[7]Altonji (1991) presents considerable evidence demonstrating the difference between ex ante and ex post expected returns. At the time that the individual makes a decision concerning major/program and degree to pursue, they must weight the return to the choice by the probability of successful completion.

[8]The data file documentation justifies the particular measure used in the empirical work as a reasonable proxy for ability. See Riccobono and others (1981), Appendix K.

uses both the logarithm of annual earnings and the log of hourly wages for w_i in the empirical models.

Table 4 provides the coefficient estimates from alternative specifications of the P vector in equation (1) for both dependent variables. The left panel presents estimates of hourly wage models estimated over the entire sample of observations with a current hourly wage (noncivilian and part-time workers were also excluded). The right panel presents similar models estimated using (log) annual earnings as the dependent variable (noncivilian workers and individuals with zero earnings were excluded). The first column of the table shows that attending a postsecondary institution appears to result in a 6 percent wage advantage (11.6 percent earnings advantage), controlling for personal, work experience, and high school background characteristics. However, the second column indicates that the wage advantage (and some of the earnings advantage) emanates from months of postsecondary attendance, which is consistent with a human capital interpretation as opposed to a signaling model. Attending postsecondary education "signals" a wage advantage in model (1), but in fact, the productivity enhancement comes from the number of months attended. Columns (3) and (7) buttress the human capital interpretation in that they show an advantage for grades earned in postsecondary schooling. The units of measurement approximate a 4.0 scale, so the interpretation on the reported coefficients is that a 1.0 improvement in postsecondary grades bestows approximately a 5 percent wage advantage and a 8 percent earnings advantage. Models (4) and (8), however, demonstrate that degrees/credentials earned are the

Table 4

Returns to Postsecondary Characteristics;
Alternative Model Specifications

(Absolute value of *t*-statistic in parentheses)

Postsecondary Characteristic	Dependent Variable/Model							
	Log (Hourly Wage)				Log (Earnings)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Attended postsecondary	.058*** (2.84)	.005 (.25)	.011 (.51)	-.031 (1.28)	.116*** (3.86)	.069** (2.21)	.078** (2.50)	.064* (1.80)
Months attended	---	.002*** (8.75)	.002*** (8.31)	.001*** (3.64)	---	.002*** (5.12)	.002*** (4.71)	.001 (1.18)
Postsecondary grades[a]	---	---	.053*** (3.73)	.040*** (2.80)	---	---	.084*** (4.01)	.069*** (3.30)
Attended a community/junior college	---	---	---	.026* (1.86)	---	---	---	-.001 (.26)
Vocational certificate/degree	---	---	---	.067*** (3.48)	---	---	---	.048* (1.66)
Bachelor's degree	---	---	---	.182*** (7.78)	---	---	---	.223*** (6.42)
Vocational cert. * bachelor's	---	---	---	-.090*** (3.22)	---	---	---	-.124*** (3.00)
Percent voc. credits[b] (÷ 100)	---	---	---	.020 (.52)	---	---	---	-.006 (.101)
$\bar{R}^2$	.2252	.2375	.2396	.2490	.2651	.2686	.2707	.2762
n	4,679				5,357			

Notes: ***Significant at the .01 level; ** significant at the .05 level; * significant at the .10 level.

[a] From transcripts. Set equal to the sample mean of 2.728 for individuals who did not pursue any postsecondary education or for whom data were missing.

[b] From transcripts. Set equal to sample mean of .1268 for individuals who did not pursue any postsecondary education.

strongest determinants of wage rates. A bachelor's degree raises wage rates by over 18 percent relative to no degree and a vocational degree or certificate raises wage rates by almost 7 percent. Obtaining both degrees results in approximately a 14 percent wage advantage. The comparable earnings advantages are 22 percent for a bachelor's degree, 5 percent for a vocational degree or certificate, and 15 percent for both.

Digression to estimates on control characteristics. Table 5 provides the coefficient estimates on the control variables used in (1). These estimates come from the models presented in columns (4) and (8) of table 4[9]. Among personal characteristics, being female, having a handicap that limits one's ability to work, and having children substantially reduce hourly wage rates or earnings, whereas being married (or having been married), living in the Northeast or in an urban area, socioeconomic status of childhood family (SES), and ability are directly related to wages and earnings. Ability is measured in units such that the standard deviation is approximately 5 units, so a one standard deviation difference in ability accounts for about a 4 percent difference in wage rates.

High school curriculum seems to influence earnings 14 years later, whereas high school grades seem to influence the hourly wage rate. Compared to an academic (or college-prep) curriculum, both the general and vocational curricula result in lower earnings--and this includes controls on postsecondary characteristics such as degree completion. The grade point average variable used in this model approximates a 13-point grading system, (A+ = 13, A = 12, A- = 11, B+ = 10, B = 9, etc.), so a 1.0 improvement in grade point average in high school confers a 3.0 percent higher wage rate.

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[9]These coefficients are very robust with respect to specification of the P vector.

Table 5

Effects of Personal, High School, and Labor Market Experience on Wage and Earnings Outcomes

Characteristic	Coefficient in Log (Hourly Wage)	absolute value of *t*-statistic	Coefficient in Log (Earnings)	absolute value of *t*-statistic
Personal and Family Characteristics				
Female	-.247***	18.20	-.477***	23.86
Minority	.006	.28	.030	.98
Ever married	.070***	4.18	.079***	3.15
No. of children	-.008	1.31	-.043***	4.46
Northeast	.062***	3.87	.048**	2.04
Urban	.078***	5.50	.061***	2.91
Handicap	-.068**	2.31	-.110**	2.50
SES	.055***	5.29	.061***	3.99
Ability	.008***	4.01	.003	1.08
High School Characteristics				
General curriculum	-.019	1.14	-.091***	3.68
Vocational curriculum	-.027	1.35	-.067**	2.25
Grades	.010***	3.67	.003	.75
Labor Market Experience				
Training	.066***	5.20	.169***	8.87
Tenure (÷ 100)	.313***	6.64	.773***	11.05
Tenure^2 (÷ 10,000)	-.129***	3.95	-.356***	7.21
Total experience (÷ 100)	.042	.43	.191	1.36
Total experience^2 (÷ 10,000)	.049	1.13	.115*	1.83

Notes: This table shows the coefficients on the control variables for models (4) and (8) in table 4.

***Significant at the .01 level; ** significant at the .05 level; * significant at the .10 level.

The labor market experience variables indicate a high return to the receipt of formal training (particularly for earnings) and tenure (wage peaks at 121 months). The total experience variable did not fit well in its quadratic form in either the wage or earnings equations, however. All together, the coefficients indicate that an additional 12 months of tenure (and thus work experience) is rewarded by about 4.1 percent higher wages (10.6 percent higher earnings).

Triage model. The triage model presented in figure 1 modifies slightly the human capital model presented in (1). This view of the world suggests that employer-employee matches are rewarded differently for individuals from the different postsecondary tracks. For example, postsecondary attendance may be a signal that opens primary jobs from secondary jobs in firms' internal labor markets. Or employers may require higher education attendance as a requirement for certain jobs. The triage model may be formally presented in the following estimating equations:

$$\text{(2a)} \qquad \ln w_i = \beta_1 X_i + \gamma_1 P_i + \epsilon_{1i}, \text{ if } p_i = 1$$

$$\text{(2b)} \qquad \ln w_i = \beta_2 X_i + \gamma_2 P_i + \epsilon_{2i}, \text{ if } p_i = 2$$

$$\text{(2c)} \qquad \ln w_i = \beta_3 X_i + \epsilon_{3i}, \text{ if } p_i = 0$$

As in (1), P_i is a vector of postsecondary characteristics; whereas p_i is a discrete indicator variable such that $p_i = 1$, if the individual pursued postsecondary technical education, $= 2$, if the individual pursued higher education, and $= 0$, if the person reported not attending any postsecondary institution. Tables 6 and 7 present the results from estimating (2a), (2b), and (2c).

Table 6

Returns to Postsecondary Characteristics; Estimated from Separate Postsecondary Outcome Samples

(Absolute value of *t*-statistic in parentheses)

Postsecondary Characteristic	Sample/Dependent Variable			
	Postsecondary Technical Education		Higher Education	
	Log (Hourly Wage)	Log (Earnings)	Log (Hourly Wage)	Log (Earnings)
Months attended	.004***	.002**	.000	-.000
	(4.71)	(2.01)	(.42)	(.40)
Postsecondary grades[a]	.028	.094**	.039**	.051*
	(1.03)	(2.47)	(2.09)	(1.86)
Attended a community/junior college	.008	-.060	.032*	.010
	(.30)	(1.56)	(3.82)	(.34)
Vocational certificate/degree	.067**	-.006	.049	.092**
	(2.33)	(.15)	(1.54)	(1.95)
Bachelor's degree	.030	.097	.180***	.236***
	(.48)	(1.03)	(6.44)	(5.70)
Voc. certificate * bachelor's	-.054	-.012	-.064*	-.168***
	(.75)	(.12)	(1.66)	(2.93)
Percent voc. credits[a] (÷ 100)	.018	-.010	.113	.043
	(.39)	(.14)	(1.49)	(.38)
$\bar{R}^2$	.2131	.2851	.1696	.2248
n	1,102	1,254	2,756	3,148

Notes: *** Significant at the .01 level; ** significant at the .05 level; * significant at the .10 level

[a] From transcripts.

Table 7

Effects of Personal, High School, and Labor Market Experience on Wage and Earnings Outcomes; Estimated from Separate Postsecondary Outcome Samples

(Absolute value of *t*-statistic in parentheses)

Characteristic	Sample/Dependent Variable					
	No Postsecondary		Postsecondary Technical Education		Higher Education	
	Log (Hourly Wage)	Log (Earnings)	Log (Hourly Wage)	Log (Earnings)	Log (Hourly Wage)	Log (Earnings)
Personal Background						
Female	-.375***	-.551***	-.200***	-.424***	-.235***	-.487***
	(11.23)	(10.58)	(7.34)	(10.70)	(12.61)	(17.82)
Minority	-.024	.010	.003	-.027	.014	.056
	(.54)	(.14)	(.07)	(.49)	(.47)	(1.27)
Ever Married	.067	.089	.087**	.089*	.068***	.083**
	(1.46)	(1.23)	(2.50)	(1.74)	(3.09)	(2.51)
No. of children	.004	.003	-.028**	-.065***	-.000	-.050***
	(.30)	(.11)	(2.26)	(3.62)	(.04)	(3.62)
Northeast	.024	.053	.015	-.051	.075***	.081**
	(.63)	(.91)	(.45)	(1.04)	(3.52)	(2.59)
Urban	.094**	.138**	.065**	.066	.080***	.031
	(2.37)	(2.15)	(2.21)	(1.54)	(4.33)	(1.13)
Handicap	-.065	-.127	-.016	.020	-.075*	-.164**
	(1.09)	(1.31)	(.29)	(.24)	(1.71)	(2.52)
SES	.090***	-.010	.039*	.057*	.052***	.083***
	(3.02)	(.21)	(1.79)	(1.83)	(3.82)	(4.08)
Ability	.009**	.012*	.008*	-.000	.010***	.001
	(2.04)	(1.71)	(1.93)	(.07)	(3.04)	(.20)

Table 7
(Continued)

Characteristic	Sample/Dependent Variable					
	No Postsecondary		Postsecondary Technical Education		Higher Education	
	Log (Hourly Wage)	Log (Earnings)	Log (Hourly Wage)	Log (Earnings)	Log (Hourly Wage)	Log (Earnings)
High School Characteristics						
General curriculum	.040 (.78)	-.002 (.02)	-.041 (1.26)	-.126*** (2.62)	-.018 (.77)	-.099*** (2.95)
Vocational curriculum	-.028 (.54)	-.105 (1.30)	-.009 (.24)	-.025 (.49)	-.013 (.38)	-.042 (.83)
Grades	.008 (1.33)	-.018* (1.85)	-.000 (.06)	.002 (.23)	.014*** (3.56)	.011* (1.86)
Labor Market Experience						
Training	.069** (2.15)	.175*** (3.46)	.119*** (4.65)	.217*** (5.78)	.050** (2.88)	.154*** (5.95)
Tenure (÷ 100)	.417*** (3.87)	.783*** (4.70)	.205*** (2.20)	.484*** (3.54)	.351*** (4.82)	.942*** (8.74)
Tenure^2 (÷ 10,000)	-.165*** (2.63)	-.343*** (3.47)	-.055 (.87)	-.209** (2.21)	-.175*** (3.11)	-.475*** (5.60)
Total experience (÷ 100)	-.140 (.75)	.294 (1.10)	.127 (.65)	.546* (1.89)	.125 (.89)	.132 (.66)
Total experience (÷ 10,000)	.133 (1.55)	.114 (.91)	.036 (.42)	-.001 (.01)	-.011 (.017)	.116 (1.28)

Notes: This table shows the coefficients on the control variables for the models displayed in table 6 for the Postsecondary Technical Education and Higher Education samples. For the No Postsecondary Sample, $\bar{R}^2$ = .3148 and n = 648 for Log (Hourly Wage) and $\bar{R}^2$ = .3482 and n = 752 for Log (Earnings).

*** Significant at the .01 level; ** significant at the .05 level; * significant at the .10 level.

Table 6 provides the estimates of the γ coefficients in (2a) and (2b). The table shows that months attended are important determinants of wages and earnings for individuals who chose postsecondary technical education, but are not rewarded for individuals who pursued higher education. Postsecondary grade point averages are significantly related to hourly wages and annual earnings for both postsecondary outcomes, however. The economic returns to credentials earned seem to be quite different for these two tracks. For postsecondary technical education attendees, there is about a 7 percent wage premium for a vocational certificate or degree and no wage benefit to obtaining a bachelor's degree. On the other hand, none of the credential variables are significantly related to earnings, although the coefficient on obtaining a bachelor's degree is fairly large. For the higher education track, large wage and earnings advantages are earned for obtaining a bachelor's degree relative to a vocational certificate or degree (18 percent compared to 5 percent for wages; 24 percent compared to 9 percent for earnings) and the reward for obtaining a bachelor's degree in addition to a vocational degree is significantly higher than earning just the vocational credential.

Table 7 presents the β coefficient estimates for equations (2a), (2b), and (2c). Most of the coefficients on the personal background and labor market experience variables have the same sign and are approximately of the same magnitude. Women seem to be disadvantaged relatively more and having resided in an urban area is more strongly related to wage rates in the no postsecondary track than for the two groups who attended postsecondary schooling. The wage advantage to formal training is greater for individuals who pursued postsecondary technical education.

There are interesting differences between the three tracks, however, in the impacts of high school characteristics on wages or earnings. Individuals in either of the postsecondary programs who reported a general curriculum in high school received 10-12 percent lower earnings rates than individuals who followed a college prep curriculum (the omitted class). However, the general curriculum does not seem to be a disadvantage for those individuals who did not pursue postsecondary education. Furthermore, high school grades are unrelated to wage rates or earnings for all but the higher education track.

The switching regression framework presented in equations (2a - c) is supported by an F-test rejection of the hypothesis that the coefficients in equation (1) are equal to the coefficients in the (unconstrained) model (2a - c).

Selection Effects

Manski (1988), Willis and Rosen (1979), and Cohn and Hughes (1989) all suggest that selection occurs in postsecondary decisionmaking, and that individuals place themselves in the appropriate track according to their own advantages. For example, Cohn and Hughes (1989) suggest that college graduates would fare better in the labor market even if the entire population had completed college and high school graduates would fare better in the labor market even if everyone stopped at that level of education.[10]

[10]This is an absolute advantage hypothesis; college graduates have an absolute advantage in those labor market opportunities that are typically restricted to incumbents with a college education and high school graduates have an absolute advantage in their labor markets. An opposing hypothesis would be that college graduates have an absolute advantage in all markets, but a comparative advantage in jobs and occupations typically held by college graduates.

This paper tests the advantage hypothesis using well-known selection correction techniques. It proceeds in a nested fashion—first testing no postsecondary versus postsecondary attendance and then within the postsecondary attendance population testing higher education versus postsecondary technical education. Equations (3a - c) simplify and modify slightly the switching regression model presented in equations (2a - c) and add an endogenous selection process.

(3a) $\ln w_a = \beta_1 X_a + \gamma P_i + \epsilon_{1i}$, if $p_i = 1$

(3b) $\ln w_a = \beta_2 X_a + \epsilon_{2i}$, if $p_i = 0$

(3c) $p_i^* = \delta Z_i + u_i$

where p_i^* is a latent variable, such that if $p_i^* \geq (<) 0$, then $p_i = 1$ (0); Z_i is a vector of personal and educational background characteristics of individual i that influence the choice of P; and u is an error term. Assume that (ϵ_{1i}, ϵ_{2i}, u_i) are distributed as a trivariate normal with 0 mean and covariance Σ. The structure of Σ is as follows:

(4) $$\Sigma = \begin{pmatrix} \sigma_1^2 & \sigma_{12} & \sigma_{1u} \\ & \sigma_2^2 & \sigma_{2u} \\ & & 1 \end{pmatrix}$$

Lee (1976) shows that $E(\epsilon 1i \mid u_i > - \delta Z_i) = \sigma_{1u} \lambda_{i+}$

and $E(\epsilon_{2i} \mid u_i < - \delta Z_i) = \sigma_{2u} \lambda_{i-}$

where $\lambda_{i+} = \phi(\delta Z_i) / \Phi(\delta Z_i)$ and $\lambda_{i-} = - \phi(\delta Z_i) / (1 - \Phi(\delta Z_i))$; where ϕ, Φ are the standard normal probability density function and cumulative density function. We can then use a first-stage probit to estimate λ_{i+} and λ_{i-} and add them to equations (3a) and (3b) as follows:

(3a') $\ln w_{si} = \beta_1' X_{si} + \gamma' P_i + s_{1u} \lambda_{i+} + e_{1i}$

(3b') $\ln w_{si} = \beta_2' X_{si} + s_{2u} \lambda_{i-} + e_{2i}$

The coefficient s_{1u} estimates the covariance between the error terms of (3a) and (3c) and the coefficient s_{2u} estimates the covariance between the error terms of (3b) and (3c). If $s_{1u} > 0$, then positive selection occurs. When the postsecondary selection equation (3c) underpredicts the probability of attending postsecondary education, then the wage equation also underpredicts. If $s_{2u} < 0$, then positive selection (into the nonpostsecondary track) has also occurred. When the postsecondary selection equation overpredicts the probability of attending, then the wage equation underpredicts the wage outcome. This is the self-selection hypothesis.

Given the high payoff to higher education, we expect positive selection into that track ($s_{1u} > 0$). The key test of the absolute advantage hypothesis is whether or not $s_{2u} < 0$. Table 8 presents the results of the estimation of equations (3a') and (3b'),[11] For the postsecondary attendees, all of the postsecondary characteristics, except for percentage of vocational credits and attending a community or junior college, are significantly related to wage rates. Transcript-reported grades and obtaining a bachelor's degree are related to earnings. Among the high school characteristics, having taken the general curriculum resulted in an earnings disadvantage, and high school grades were positively related to wage rates. As expected, the coefficient of the Mills ratio was positive, although not significant,

[11]Tables 8 and 9 provide OLS estimates. Not reported are coefficient estimates from heteroscedasticity-corrected weighted least squares estimation of (3a'), (3b'), (4a), and (4b). (See Maddala 1983). The weighted least squares estimates were virtually identical to the reported estimates.

Table 8

Estimates from the Switching Regression Equation Model with Selection Bias Correction—Postsecondary versus No Postsecondary

Characteristic	Sample/Dependent Variable			
	No Postsecondary		Postsecondary[a]	
	Log (Hourly Wage)	Log (Earnings)	Log (Hourly Wage)	Log (Earnings)
Personal Background				
Female	-.342***	-.539***	-.227***	-.466***
	(9.43)	(9.56)	(12.87)	(18.37)
Minority	.029	.126	.019	.047
	(.37)	(1.04)	(.59)	(1.00)
Ever married	.006	.006	.074***	.069**
	(.11)	(.07)	(3.55)	(2.26)
No. of children	.003	.010	-.012	-.041***
	(.17)	(.41)	(1.41)	(3.32)
Northeast	.038	.084	.067***	.056*
	(.91)	(1.30)	(3.24)	(1.86)
Urban	.097***	.174***	.061***	.029
	(2.66)	(2.55)	(3.47)	(1.13)
Handicap	-.089	-.023	-.071*	-.118**
	(1.36)	(.22)	(1.83)	(2.03)
SES	.094*	.101	.070***	.101***
	(1.84)	(1.30)	(3.87)	(3.80)
Ability	.011	.026	.013***	.005
	(1.04)	(1.54)	(2.92)	(.74)
High School Characteristics				
General curriculum	.052	-.007	-.032	-.085***
	(.95)	(.08)	(1.54)	(2.80)
Vocational curriculum	-.026	-.147*	.028	.024
	(.48)	(1.72)	(1.01)	(.60)
Grades	.010	-.012	.010***	.009
	(1.47)	(1.16)	(2.71)	(1.60)
Labor Market Experience				
Training	.054	.169***	.061***	.138***
	(1.56)	(3.09)	(3.74)	(5.83)
Tenure (÷ 100)	.377***	.808***	.275***	.783***
	(3.75)	(4.54)	(4.23)	(8.23)

Table 8
(Continued)

Characteristic	Sample/Dependent Variable			
	No Postsecondary		Postsecondary*	
	Log (Hourly Wage)	Log (Earnings)	Log (Hourly Wage)	Log (Earnings)
Tenure^2 (÷ 10,000)	-.135** (1.97)	-.323** (3.00)	-.109** (2.25)	-.364** (5.08)
Total experience (÷ 100)	-.065 (.33)	.285 (.99)	.205 (1.46)	.394** (1.97)
Total experience^2 (÷ 10,000)	.115 (1.20)	.092 (.69)	-.027 (.44)	.020 (.23)
Postsecondary Characteristics				
Months attended	n/a	n/a	.001** (2.85)	.000 (.45)
Grades	n/a	n/a	.045** (3.00)	.064** (2.97)
Attended a community/junior college	n/a	n/a	.024 (1.42)	.012 (.46)
Vocational certificate or degree	n/a	n/a	.045* (1.81)	.035 (.99)
Bachelor's	n/a	n/a	.169** (6.18)	.222** (5.57)
Voc. cert * Bachelor's	n/a	n/a	-.077** (2.32)	-.095* (1.95)
Percent voc. credits	n/a	n/a	.006 (.13)	-.048 (.67)
Selection Correction				
λ	.026 (.14)	.353 (1.16)	.103 (.95)	.144 (.90)
$\bar{R}^2$	.3136	.3525	.2035	.2449
n	520	609	2,979	3,374

Notes: ** Significant at the .01 level; * significant at the .05 level; * significant at the .10 level.

* Includes both postsecondary technical education and higher education attendees.

signaling potential positive selection into postsecondary schooling. For individuals who did not attend any postsecondary program, job training, tenure, sex, and residing in an urban community are the primary determinants of wages and earnings. High school characteristics are not particularly strong explanatory factors (the vocational curriculum does have a negative impact on earnings that is statistically significant). Most importantly, the coefficient on λ is not negative. Therefore we cannot assume that the individuals left out of the postsecondary track are there because of an absolute advantage.

To test for absolute advantage between postsecondary technical education and higher education, the following models were estimated:

(4a) $$\ln w_{ai} = \beta_1 X_{ai} + \gamma H_i + s_{1a} \lambda_{1i} + e_{1i}$$

(4b) $$\ln w_{ai} = \beta_2 X_{ai} + s_{2a} \lambda_{2i} + e_{2i}$$

where $H_i = 1$, if the individual pursued higher education and $= 0$, if they pursued postsecondary technical education and $\lambda_{1i} = \phi(\delta Z_i) / \Phi(\delta Z_i)$ and $\lambda_{2i} = -\phi(\delta Z_i) / (1 - \Phi(\delta Z_i))$ from the 1st-stage Probit:

(4c) $$H_i^* = \delta Z_i + u_i$$

Again, we expect that $s_{1a} > 0$ indicating positive selection, and the question is whether there is an absolute advantage for individuals in postsecondary technical education, i.e. $s_{2a} < 0$.

The results from estimating (5a) and (5b) are provided in table 9. In this case, the positive selection for higher education is strongly significant. And once again the hypothesis of absolute advantage does not hold for the non-selected group, students pursuing postsecondary technical education. In fact for earnings, the coefficient is statistically significant and positive (which is the wrong sign for the absolute advantage hypothesis).

Table 9

Estimates from the Switching Regression Equation Model with Selection Bias Correction—Postsecondary Technical Education versus Higher Education
(Absolute value of *t*-statistics in parentheses)

Characteristic	Sample/Dependent Variable			
	Postsecondary Technical Education		Higher Education	
	Log (Hourly Wage)	Log (Earnings)	Log (Hourly Wage)	Log (Earnings)
Personal Background				
Female	-.192*** (4.70)	-.492*** (8.41)	-.266*** (11.68)	-.516*** (15.45)
Minority	.138 (1.14)	.430** (2.49)	.126** (2.22)	.168** (2.00)
Ever married	.056 (1.32)	.066 (1.09)	.077*** (3.09)	.084** (2.28)
No. of children	-.030** (2.02)	-.049** (2.32)	.001 (.10)	-.042*** (2.75)
Northeast	.041 (.92)	.010 (.16)	.089*** (3.66)	.082** (2.28)
Urban	.037 (1.05)	.026 (.52)	.066*** (3.25)	.017 (.56)
Handicap	.029 (.41)	.087 (.84)	-.123** (2.49)	-.247*** (3.34)
SES	.121* (1.71)	.327*** (3.25)	.137*** (4.49)	.158*** (3.53)
Ability	.039 (1.49)	.109*** (2.93)	.045*** (3.56)	.032* (1.72
High School Characteristics				
General curriculum	-.081 (.40)	-.116** (2.05)	-.013 (.52)	-.088** (2.38)
Vocational curriculum	.026 (.58)	.047 (.76)	.009 (.24)	-.021 (.37)
Grades	.003 (.42)	.007 (.68)	.011** (2.45)	.007 (1.07)
Labor Market Experience				
Training	.095*** (3.04)	.175*** (3.87)	.051*** (2.66)	.132*** (4.60)

Table 9
(Continued)

Characteristic	Sample/Dependent Variable			
	Postsecondary Technical Education		Higher Education	
	Log (Hourly Wage)	Log (Earnings)	Log (Hourly Wage)	Log (Earnings)
Tenure (÷ 100)	.163	.463***	.315***	.900***
	(1.40)	(2.75)	(3.86)	(7.49)
Tenure^2	-.031	-.177	-.147**	-.440***
(÷ 10,000)	(.39)	(1.51)	(2.33)	(4.67)
Total experience	.535*	1.329***	.130	.092
(÷ 100)	(1.78)	(3.37)	(.78)	(.38)
Total experience^2	-.127	-.340*	-.007	.138
(÷ 10,000)	(.99)	(1.96)	(.10)	(1.29)
Postsecondary Characteristics				
Months attended	.003***	.002	.001	-.000
	(2.81)	(1.34)	(1.20)	(.09)
Grades	.011	.069*	.059***	.056**
	(.42)	(1.93)	(3.08)	(1.99)
Attended a community/junior college	.010	-.045	.020	.019
	(.30)	(.99)	(.96)	(.61)
Vocational certificate or degree	.046	-.040	.045	.073
	(1.26)	(.75)	(1.23)	(1.37)
Bachelor's	.063	.068	.161***	.236***
	(.86)	(.65)	(5.09)	(5.07)
Voc. cert. * Bachelor's	-.059	.068	-.061	-.126**
	(.73)	(.58)	(1.39)	(1.97)
Percent voc. credits	.013	-.070	.111	-.023
	(.22)	(.80)	(1.29)	(.18)
Selection Correction				
λ	.424	1.55***	.708***	.612*
R^2	.1903	.2868	.1780	.2286
n	702	790	2,186	2,483

Notes: *** Significant at the .01 level; ** significant at the .05 level; * significant at the .10 level.

Discussion

To characterize rigorously the U.S. system of postsecondary education as a process of triage would require classical experimentation with repeated trials; experimentation that is impossible to conduct. However, the empirical findings presented in this paper suggest that the characterization seems to be valid. Wage and earnings models yield somewhat different structural parameter estimates when estimated over populations of individuals who (1) did not attend any postsecondary institution, (2) chose postsecondary technical education, and (3) chose higher education. In particular, high school background variables are related differently to earnings and wages across the three groups; and postsecondary characteristics effects differ for the two groups that attended some form of postsecondary education.

The empirical results from the technique used to correct for selection effects suggest that individuals' choices into the three tracks are not the result of absolute advantage. That is, the results are not consistent with the hypothesis that postsecondary technical education students would fare better in the labor market than higher education students if the higher education students would have pursued postsecondary technical education nor with the hypothesis that individuals who did not pursue any form of postsecondary education would fare better in a labor market where no one had pursued postsecondary education.

The characteristics that get reflected in wages and earnings for individuals who pursued postsecondary technical education are more consistent with a human capital story than for individuals who pursued higher education. Tables 6 and 7 show that the former have significant, positive returns from months of postsecondary schooling attendance, postsecondary grades (as reported on their transcripts), and from formal on-the-job training that are larger in magnitude than for individuals who pursued the higher education track.

The latter group benefitted significantly from receiving a bachelor's degree and/or a vocational certificate, whereas a credential was not significantly related to earnings or wage rates for the postsecondary technical education students. Furthermore, months of postsecondary education attended was not related to wages or earnings for higher education students.

The lack of effect of high school grades on students from the postsecondary track supports the Bishop (1987) contention that employers are not paying attention to high school grades in rewarding workers, although this finding is attenuated by the fact that the earnings and wages observed are being earned approximately 14 years after high school.

All of the empirical findings reported here come from a particular cohort of students who were classified as seniors in high school in 1972. Furthermore, the economic outcomes are limited to those that occurred in 1985/86. Thus the models and results may not generalize to other cohorts of students nor to lifetime earnings. Other data sets such as the cohorts from the High School and Beyond study should be analyzed to provide support for the models/conclusions provided here.

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